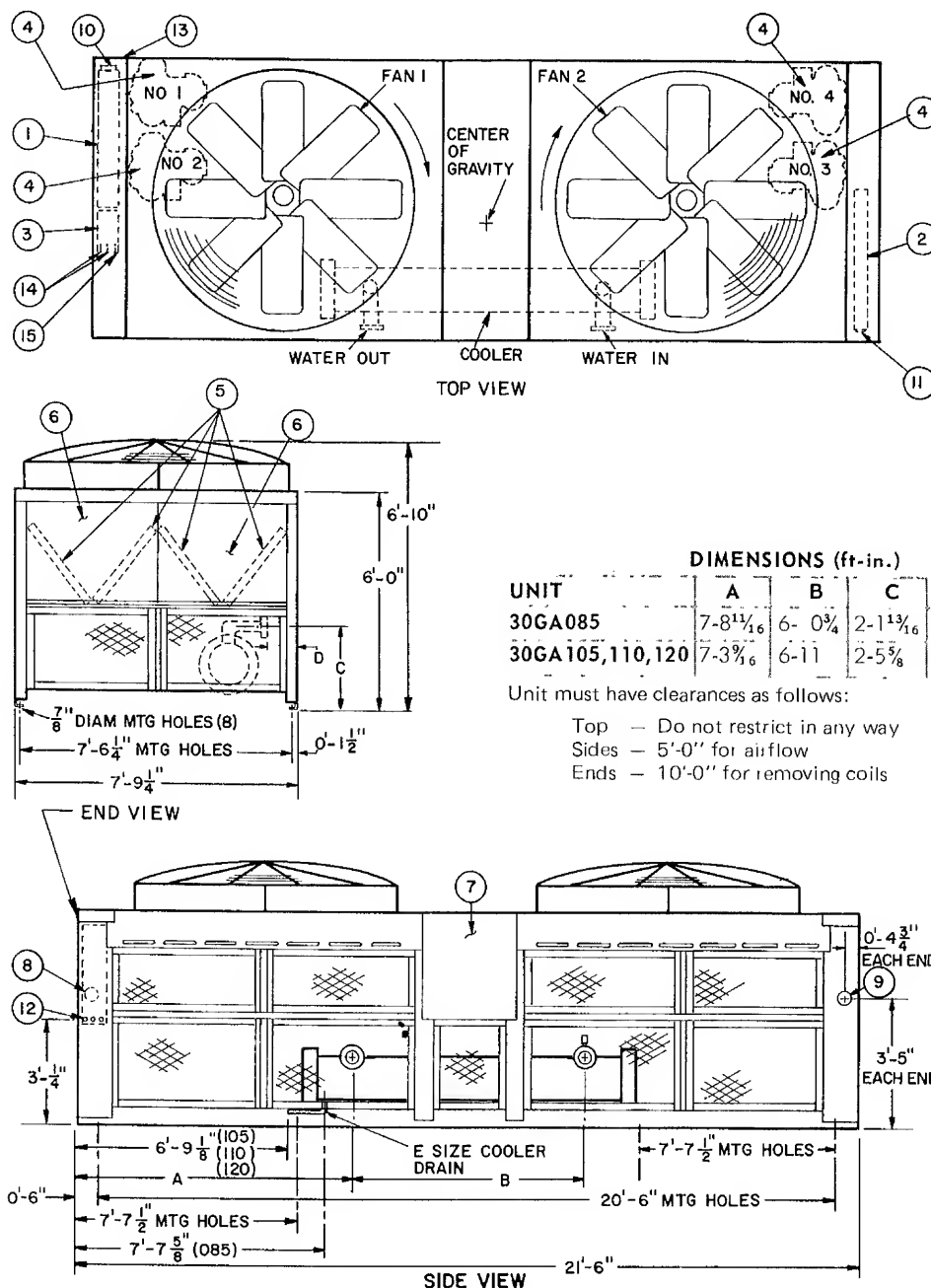


Reciprocating Liquid Chillers

Air-Cooled Packages



- LEGEND for Fig. 1 (callouts)**
- 1 — Electrical box, circuit 1
 - 2 — Electrical box, circuit 2
 - 3 — Unit control box
 - 4 — Compressor (1 and 2, circuit 1; 3 and 4, circuit 2)
 - 5 — Condenser coils
 - 6 — Removable access panels (each end)
 - 7 — Removable access panels (each side)
 - 8 — 4-5/8 in. diam hole in corner post (farside) Main power supply, circuit 1
 - 9 — 4-5/8 in. diam hole in corner post Main power supply, circuit 2
 - 10 — 3-in. FPT straight pipe in electrical box Power supply, Ckt 1
 - 11 — 3-in. FPT straight pipe in electrical box Power supply, Ckt 2
 - 12 — 3-1/4 in. diam holes in corner post Control power and field interlocks
 - 13 — 3-1/4 in. diam holes in corner post (in line vertically) Control power and field interlocks
 - 14 — 2-7/8 in. diam knockouts in control box Field interlocks
 - 15 — 7/8 in. diam hole in control box Control power supply

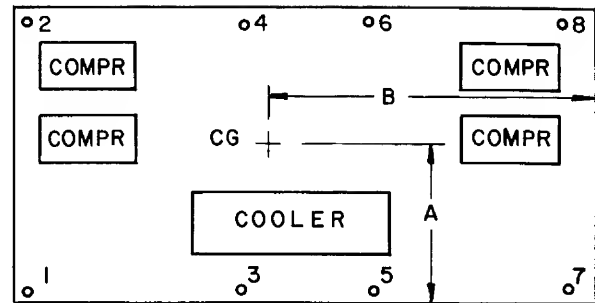
Fig. 1 — Dimension Drawing

Table 1 — Weight Distribution

UNIT 30GA	CG DIM. (in.)		APPROX OPER WT (lb)	SUPPORT POINT (See Diagram)							
	A	B		1	2	3	4	5	6	7	8
				Weight (lb)							
085	47	129	9,200	950	950	1320	1380	1320	1380	950	950
105	45	129	10,350	1130	1030	1550	1465	1550	1465	1130	1030
110	45	129	10,480	1150	1050	1560	1480	1560	1480	1150	1050
120	45	129	10,720	1190	1090	1590	1490	1590	1490	1190	1090

CG — Center of Gravity

NOTE: Support points 1 - 8 are at mounting holes in the base rail flange



INSTALLATION

Rigging — The recommended method of rigging these units is with 2 field-supplied pipes thru the holes at the ends of the base frame. Use 2-1/2 in. standard weight pipes 10 ft long. Four cables, minimum of 20 ft long, hooked around the pipe ends with two 98-in. long spreaders should keep the cables clear of the unit sides (see rigging label on side of unit).

Placing the Unit — The unit may be positioned with a crane while the rigging is still on or it can be moved on the surface. If positioned from above, remove the rail skids before placing. If the unit is dragged into position, leave the skid rails on until final placement. If the unit is rolled into position, remove the skid rails before placing the rollers. Use minimum of 3 rollers to distribute the load. If the unit is to rest on pads or if special floor or roof supports are required, locate the supports with respect to weight distribution shown in Table 1.

The unit must be located with a minimum clearance of 5 ft on the sides and 10 ft at the ends for servicing and for airflow. *There must be no restriction of any kind above the unit.*

Compressor Mounting — The 2 compressors at each end are mounted rigidly on a double-rail base. The base is mounted on springs at 6 points, 3 under each rail. For shipping, 6 bolts thru these springs hold the compressors secure. *At installation, remove the 6 bolts so that the compressor-rail assembly floats freely on the springs.*

→ **Chilled Water and Drain Piping** (See Fig. 1) — Facing the cooler side of the unit, the return water connection is at the right and the leaving water connection at the left. At installation, holes must be cut in the metal screen for field piping and insulation. After installation, all field piping should be protected against freezing. This includes electric heating tapes covered with a suitable thickness of closed-cell insulation, or an ethylene glycol solution may be used. On 60-Hz units, a 115 volt convenience outlet is provided as the power source for the pipe heaters. A chilled water flow switch is factory-installed in the cooler return water nozzle.

The drain connection is located at the leaving water end of the cooler.

Power Supply — Electrical characteristics of avail-

able power supply must agree with unit nameplate rating. Supply voltage must be within the limits shown in Table 2. *Operation of unit on improper supply voltage or with excessive phase unbalance constitutes abuse and is not covered by Carrier warranty*

Field Power Connections — All power wiring must comply with applicable local and national codes. Install field-supplied branch circuit disconnects of a type that can be locked OFF or OPEN.

MAIN POWER — The electrical box at each end of the unit contains components and wiring for one of the 2 circuits. Separate power wires go to each box, entering the unit thru the large holes in the corner posts (see Fig. 1). The main power wires are connected to terminals in electrical boxes. (TB1 in Circuit 1 and TB2 in Circuit 2). The terminal block connectors are suitable for either copper or aluminum wire up to 500 MCM. Check fan rotation. The correct direction is clockwise, viewed from above. If rotation is in the wrong direction, interchange 2 of the power leads.

CONTROL POWER — The control power box is at the circuit no. 1 end of the unit (on the left, facing the cooler side). A separate single-phase source for the control circuit must be field installed (115 volts for 60-Hertz; 230 volts for 50-Hertz). This power is to be wired thru a field-supplied 15-amp fused disconnect, entering the unit thru either corner post (see Fig. 1) and into the right side of the control box. Connect to terminals on TB3 (see Label Diagram). *Except for servicing, control power should never be disconnected.* This ensures continuous power supply to the heaters protecting the compressors, cooler and chilled water piping.

→ **CONTROL CIRCUIT INTERLOCKS** — Auxiliary contacts for the chilled water pump starter (CWPS) should be installed in the control circuit as protection against unit operation when pump is not running. These interlocks are made by running the wires from the remote pump starter thru an opening in the right side of the control box, and connecting to terminals 2 and 3 on TB4. Remove violet wire between terminals 2 and 3 (see Label Diagram).

Table 2 – Electrical Data (60-Hz)

30GA	UNIT				EACH CIRCUIT					EACH COMPRESSOR						
	Model	Volts		Supplied*	Max Kw†		ICF	MCA	Max Fuse Amps	Compressor No.						
		Motor Nameplate	Min Max		Comprs and Fan	Comprs Only				1 and 3			2 and 4			
										RLA	LRA	MTA	RLA	LRA	MTA	
→ 085	410	200	180	229	64.2	59.2	492	253	350	116	506/304	80	82	345/207	57	
	510	230	207	264			429	224	300	104	440/264	72	72	300/180	50	
	610	460	414	528			215	112	150	52	220	71	36	150	50	
	110	575	518	660			170	89	110	41	176	57	29	120	40	
105	410	200	180	229	74.7	69.7	647	287	400	116	506/304	80	116	506/304	80	
	510	230	207	264			563	256	350	104	440/264	72	104	440/264	72	
	610	460	414	528			282	128	175	52	220	71	52	220	71	
	110	575	518	660			226	101	125	41	176	57	41	176	57	
→ 110	400	200	180	229	92.5	86.0	841	356	500	116	506/304	80	164	690/414	115	
	500	230	207	264			732	319	450	104	440/264	72	150	600/360	105	
	600	460	414	528			366	161	225	52	220	71	76	300/180	53	
	100	575	518	660			293	127	175	41	176	57	59	240	82	
→ 120	400	200	180	229	105.9	99.4	889	405	500	164	690/414	115	164	690/414	115	
	500	230	207	264			778	365	500	150	600/360	105	150	600/360	105	
	600	460	414	528			390	185	250	76	300/180	53	76	300/180	53	
	100	575	518	660			311	145	200	59	240	82	59	240	82	

UNIT 30GA	VOLTS	SEE NOTE 1	EACH FAN MOTOR					
			Circuit 1			Circuit 2		
			Hp	FLA	MTA	Hp	FLA	MTA
085 and 105	200	Standard	7.5	25.4	34.1	7.5	25.4	34.1
		FIOP	7.5	25.4	34.1	7.5	23.8	31.9
						1.9	9.5	11.5
	230	Standard	7.5	22.0	30.2	7.5	22.0	30.2
		FIOP	7.5	22.0	30.2	7.5	21.7	28.9
						1.9	8.4	10.4
	460	Standard	7.5	11.0	15.1	7.5	11.0	15.1
		FIOP	7.5	11.0	15.1	7.5	10.3	14.4
						1.9	4.1	5.1
	575	Standard	7.5	8.8	12.0	7.5	8.8	12.0
		FIOP	7.5	8.8	12.0	7.5	8.3	11.3
						1.9	3.3	4.6
110 and 120	200	Standard	10.0	34.4	44.0	10.0	34.4	44.0
		FIOP	10.0	34.4	44.0	10.0	31.0	44.0
						2.5	11.0	15.4
	230	Standard	10.0	27.2	38.0	10.0	27.2	38.0
		FIOP	10.0	27.2	38.0	10.0	26.6	38.0
						2.5	9.6	13.4
	460	Standard	10.0	13.6	19.3	10.0	13.6	19.3
		FIOP	10.0	13.6	19.3	10.0	13.3	19.3
						2.5	4.8	6.9
	575	Standard	10.0	11.6	16.2	10.0	11.6	16.2
		FIOP	10.0	11.6	16.2	10.0	11.6	16.2
						2.5	4.2	5.8

Optional Condenser Fan Motor at half speed

FIOP — Factory-Installed Option

FLA — Full Load Amps (Fan Motors)

Hp — NEC Horsepower

ICF — Instantaneous Current Flow during start-up (Full LRA for last compressor to start plus the sum of the RLA for all running compressors plus the FLA for the fan motors)

Kw — Power Input

LRA — Locked Rotor Amps *Values in italics* are for part-winding start. The larger values are full LRA

MCA — Minimum Circuit Amps Complies with NEC, Section 430-24

MTA — Must Trip Amps (Circuit breaker)

RLA — Rated Load Amps (Compressor motors)

*Units are suitable for use on electrical systems where voltage supplied to the unit terminals is never below or above the listed minimum and maximum limits

†At operating conditions of 50 F leaving water temperature, 115 F condenser entering air temperature and nominal voltage

NOTES:

1 For FIOP, Circuit 1 has a standard fan motor and Circuit 2 has a special 2-speed fan motor to supplement fan cycling for head pressure control. The special motor runs at half speed at low ambient temperature

2 Maximum allowable phase unbalance: voltage, 2%, amperes, 10%

START-UP AND SERVICE

INITIAL CHECK

Do not attempt to start the Liquid Chiller, even momentarily, until the following steps have been completed:

1. Check operation of all auxiliary components such as circulating pumps, air handling equipment, or other equipment to which the chiller is connected. Consult the manufacturer's instructions.
2. Check chilled water safety thermostat. See Safety Thermostat for adjustment.
3. Backseat (open) compressor suction and discharge shutoff valves. Close valves one turn to allow pressure to reach test gages.
4. Open liquid line service valves.
5. Fill chilled water circuit with clean water or other noncorrosive fluids to be cooled. Bleed all air out of high points of system.
6. Set temperature controller (see Capacity Control).

7. Check tightness of all electrical connections.
8. Be sure there are no refrigerant leaks (see Leak Test and Dehydration).
9. Be sure there is oil in the compressor (see Oil Charge).
10. Electrical power source must agree with unit nameplate rating.
11. Crankcase heater must be firmly locked into compressor crankcase.
12. Check compressor suspension. The mounting rails must be floating freely on the springs.

LEAK TEST AND DEHYDRATION

For proper procedure, refer to Standard Service Techniques Manual, Chapter 1, Refrigerants.

All 30GA Units are fully charged with R-22 at the factory (see Table 3). A leak test should be performed at time of installation to assure that leaks have not developed during shipment. Dehydration is not necessary unless complete refrigerant charge has been lost.

Table 3 — Physical Data

UNIT 30GA	085		105		110		120	
UNIT WEIGHT (lb)								
Shipping	9250		10,250		9,980		10,220	
Operating	9200		10,350		10,480		10,720	
REFRIGERANT (R-22)								
Charge per Circuit (lb)	67		90		90		90	
COMPRESSORS (06E)*	Ckt 1	Ckt 2	Ckt 1	Ckt 2	Ckt 1	Ckt 2	Ckt 1	Ckt 2
(Lead) No. 1 3	J275	F275	J275	F275	J275	F275	J299	F299
(Lag) No. 2 4	A250	A250	F275	F275	F299	F299	F299	F299
Cylinder/Compressor	250-4; 275-6		6		6		6	
Oil Charge/Compressor (pt)	250-14; 275-19		19		19		19	
CONDENSER FANS	Propeller, Belt Drive							
No. ... Diam (in.) ... Rpm	2 ... 84 ... 288				2 ... 84 ... 318			
Total Air Flow (cfm)	79,200		75,000		81,000		81,000	
CONDENSER COILS								
No./Circuit								
Total/Unit								
Rows/Coil { Deep	2				3			
High								
Fins/Inch					30			
Total Face Area (sq ft)					16			
Total External Surface (sq ft)	8096				174		12,140	
Max Design Working Pressure (psig)					450			
COOLER (one)	Shell and Tube							
Refrigerant Circuits					2			
Max Design Working Pressure (psig)					Refrigerant Side - 235			
Net Water Volume (gal.)	20				Water Side - 150		37	
WATER CONNECTIONS (in.)								
Inlet and Outlet (flange)	4				5			
Drain	¾ FPT				¾ MPT			
REFRIG CONNECTIONS (in.)								
Liquid (ODM)					1⅝			
Suction (ODM)					2⅝			

*Prefix: J = one unloader; A,F = no unloader

REFRIGERANT CHARGING

On the liquid line shutoff (service) valve in each circuit, there is a 1/4-in. flare connection for charging refrigerant (see Fig. 2). *Close the valve when charging.* Refrigerant entering thru the flare connection will flow downstream. Charge each circuit with the saturated condensing temperature at 125 F until the sight glass is full and clear. (This is the minimum operating charge.) Then add 11.5 lb per circuit for optimum charge. As an alternate method, weigh in the proper charge weight per unit nameplate.

START-UP

Start-up should be performed only under supervision of experienced refrigeration mechanic.

1. Be sure all compressors are warm (crankcase heaters should be energized for 24 hours before start-up).
2. Open all system valves that may have been closed during or after charging.
3. Check air-handling equipment, chilled water and condenser water pumps, and any other equipment connected to chiller for proper operation.
4. Close ON-OFF switch on control panel to start unit.

5. Check all controls for proper operation. (Follow checking procedures given in these instructions.)
6. Check chilled water leaving temperature to see that it remains well above freezing.

OIL CHARGE

All units are factory charged with oil (see Table 3).

Observe oil level closely at start-up. If oil level is below bull's-eye and cannot be seen, add oil until level is approximately 1/4 bull's-eye. Refer to Carrier Standard Service Techniques Manual, Chapter 1, Refrigerants for procedures to add or remove oil.

When additional oil, or a complete charge, is required, use only Carrier-approved compressor oil.

Approved oils are:

Sun Oil Company	Suniso 3GS
Texaco, Inc.	Capella B1
E.I. DuPont Company	DuPont Synthetic
		Refrigeration Oil (150 SSU only)

Do not reuse drained oil or use any oil that has been exposed to atmosphere.

REFRIGERANT FEED COMPONENTS

Each circuit has all of the necessary refrigerant controls (see Fig. 2).

Thermostatic Expansion Valve (TXV) controls flow of refrigerant into each cooler circuit separately. Valve is activated thru temperature sensing bulb clamped on the suction line for each circuit.

Filter-drier — Shells with replaceable cores are standard on each circuit.

Liquid Line Solenoid Valve is downstream of and close to the filter-drier, and prevents liquid refrigerant from migrating to the cooler during shutdown. This valve closes when its circuit is not operating for any of the following reasons: capacity control, shutdown or unit lock-out on compressor overtemperature, loss of compressor oil pressure.

Moisture-Liquid Indicator is located just ahead of the thermal expansion valve. Clear flow of liquid

refrigerant indicates sufficient charge in system. Bubbles indicate undercharged system or presence of noncondensibles. Moisture, measured in parts per million (ppm) in system, will change color of indicator. Blue indicates a safe, dry condition while pink shows that a dangerous moisture level is present. The first sign of moisture would be a faded blue, or light violet color. Change filter-drier cores at first sign of moisture in system.

***IMPORTANT** Unit must be in operation at least 12 hours before moisture indicator will give an accurate reading. With unit running, indicating element must be in contact with liquid refrigerant to give true moisture indication*

Liquid Line Service Valve is immediately ahead of the filter-drier. This valve provides a refrigerant charging port and in combination with the compressor discharge service valve, allows each circuit to be pumped down into the high side.

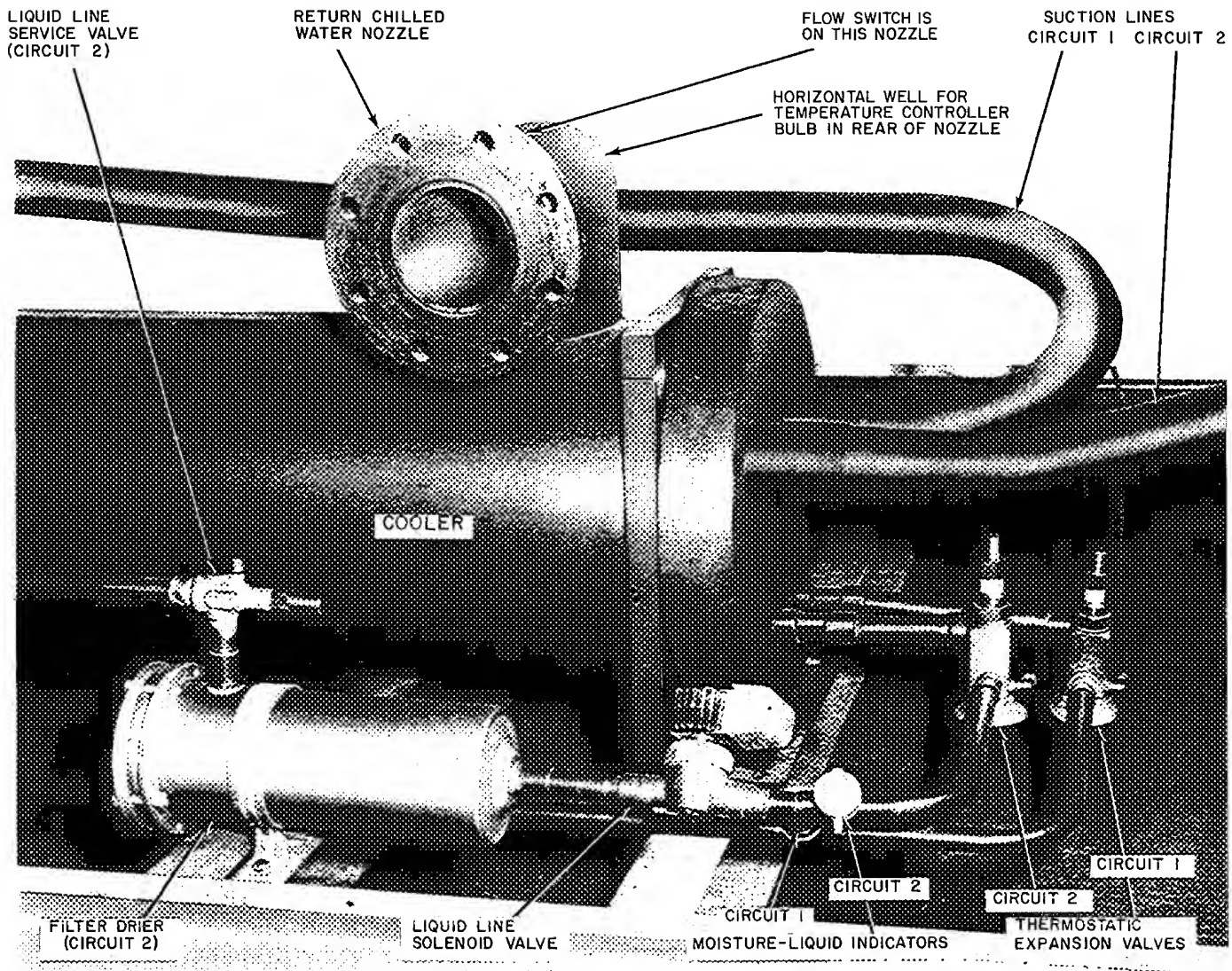


Fig. 2 — Refrigerant Feed Components and Cooler

COMPRESSOR PROTECTION

Circuit Breakers — One manual reset calibrated trip magnetic circuit breaker for each compressor protects against overcurrent. Do not bypass connections or increase size of breaker to correct trouble. Determine the cause for the trouble and correct before resetting breaker. Circuit breaker must trip amps (MTA) are listed in Table 2, Electrical Data.

Over Temperature Protectors — A sensor in the discharge side of each compressor (Fig. 3) reacts to excessively high discharge temperature and shuts off the compressor.

Crankcase Heaters (Fig. 3) — Each compressor has an electric heater located in the bottom cover, held in place by a clip and bracket. Heater must be tight

to prevent backing out (*heater will burn out if exposed to air*). Each heater is wired from L1 to L2 in the control circuit and is energized continuously. This keeps the oil at a temperature which will prevent excessive absorption of refrigerant by the oil during shutdown periods.

Crankcase heaters should be energized at all times when unit is not operating. However, during a prolonged shutdown, or during servicing, the heaters may be de-energized providing compressor service valves are closed. When operation is to resume, the service valves must be reopened and the heaters should be energized for 24 hours before unit start-up.

Time Guard® Function — This exclusive Carrier feature prevents compressors from short cycling.

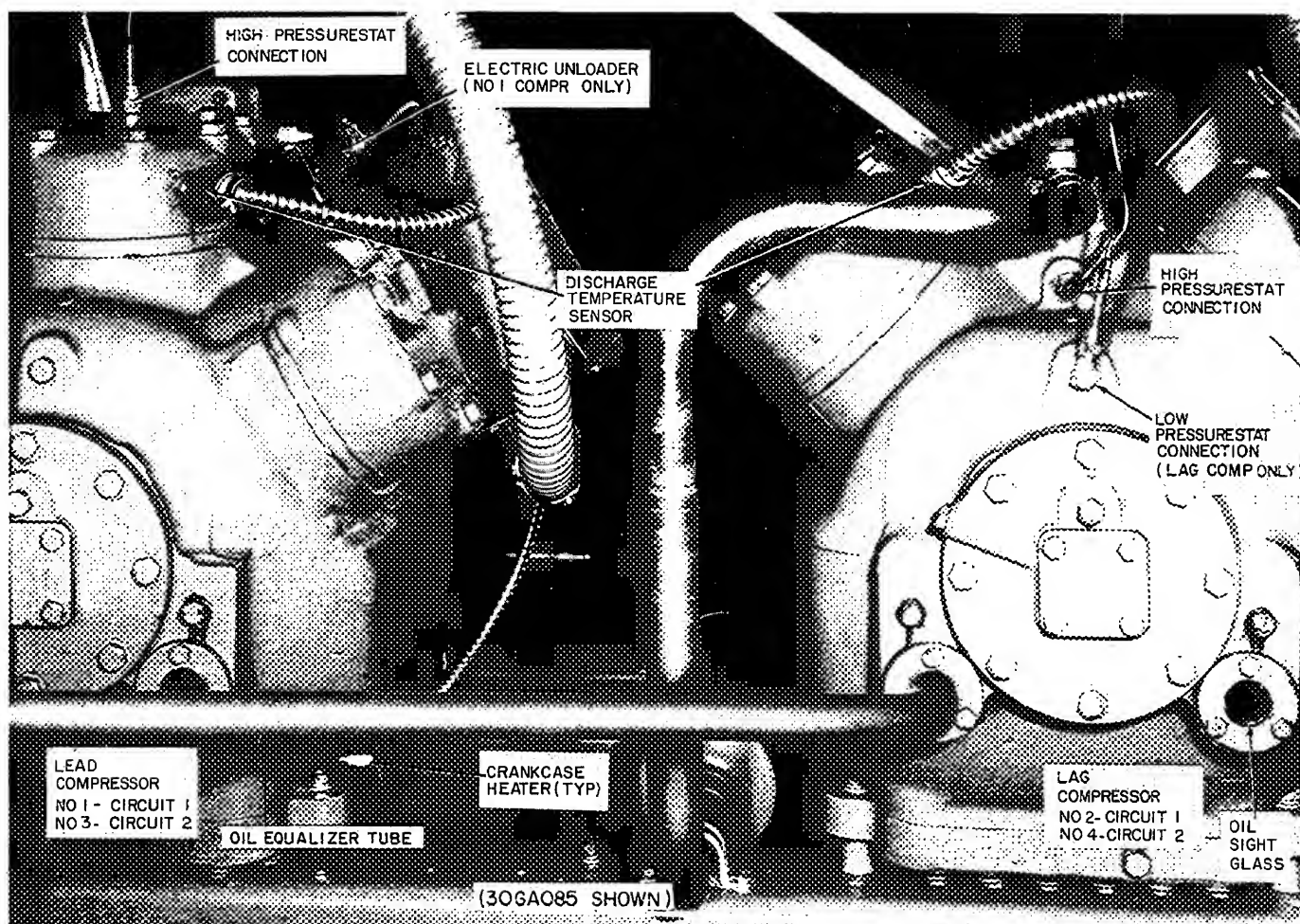


Fig. 3 — Compressor Connections (Each Circuit)

COOLER PROTECTION

Insulation — A thick layer of close-fitting flexible, vaportight closed-cell plastic insulation protects the cooler against heat transfer between it and the ambient air.

Heater Cables — During winter, the cooler is protected against freeze-up by 2 thermostatically controlled 200-watt heater cables, wound helically

around the entire length between the shell and the insulation. These heaters are energized whenever the ambient temperature is 40 F or lower. They are in the separate 115-volt control power circuit, so that even though the main power is off for any reason, heater circuit power is assured. On 60-Hertz units, a 115-volt convenience outlet is provided as a power source for field-supplied heating tapes for wrapping around the connecting

chilled water piping. Also, the chilled water piping may be covered with field-supplied insulation over the heating element. The combined heaters and insulation will protect the cooler and connecting piping down to -20°F ambient.

Winter Shutdown — If unit is to be shut down for winter, remove drain plugs and drain cooler. Use air pressure to blow out any residual water. As an alternate procedure, refill with 50/50 mixture of ethylene glycol and water.

SAFETY THERMOSTAT

The low water temperature cutout (Fig. 4) is a noncycling, manual-reset type, to protect against freeze-up due to operating malfunction. The sensing bulb is installed in top of cooler shell at leaving chilled water end. Freezestat is set to break the control circuit at $36 \pm 2^{\circ}\text{F}$, locking out the unit. The thermostat must be reset before the unit can restart. The chilled water circulating pump continues to operate during the lockout period.

Check thermostat at installation and at least once each season thereafter.

To Check — Insert screwdriver into adjusting slot and turn dial assembly until desired cutoff temperature is directly under fixed indicator. Place bulb in vacuum bottle filled with mixture of water and crushed ice. Stir mixture with thermometer; as ice melts, temperature of mixture will go down. Note temperature where thermostat cuts out. This should be within one or 2 degrees of dial setting. Recalibrate if variation is greater.

To Recalibrate — Break painted seal at dial screw. With a screwdriver in the adjusting slot, *hold the angular position of the dial assembly while completing the following steps:*

1. Loosen the 2 dial screws.
2. Rotate *dial only* until the number under the fixed indicator is the observed temperature of the mixture.
3. Retighten dial screws.

Turn dial assembly until desired compressor cutoff temperature is directly under fixed indicator. Recalibration is now complete.

HIGH AND LOW PRESSURESTATS

For each compressor, a high-pressure switch (HPS) is provided; for each *circuit* there is *one* low-pressure switch (LPS) connected to the lag compressor. (See Fig. 3.)

The high-pressure switch settings are non-adjustable. The low-pressure switch has an adjustable pressure range from 10-90 psig and the differential is adjustable, 15-45 psig. Table 4 shows the factory settings for these switches. After tripping, and turning off the compressor(s), the

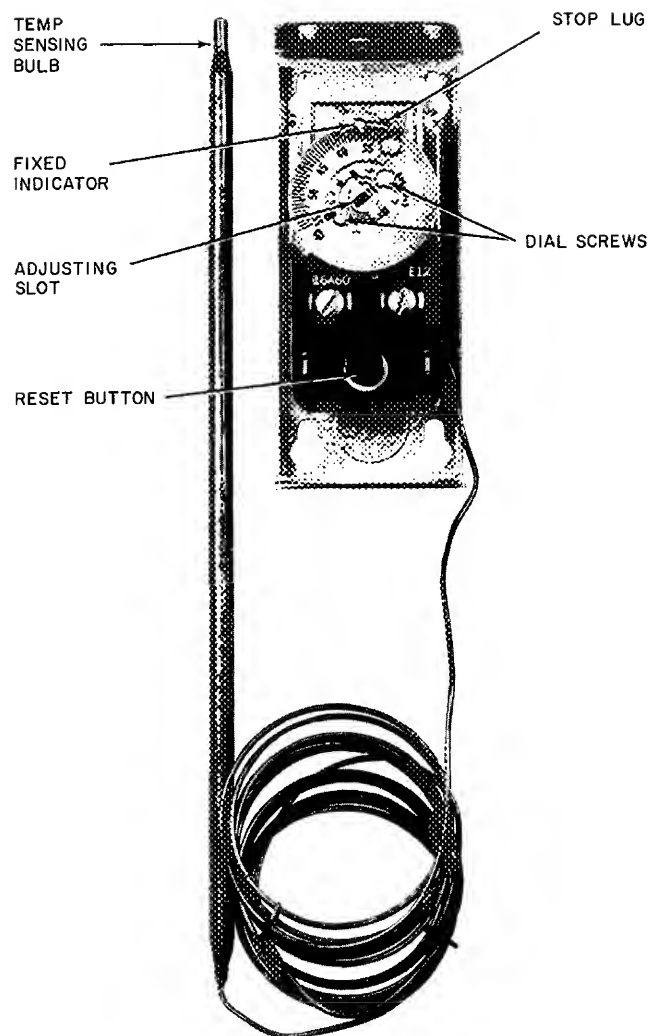


Fig. 4 — Safety Thermostat

pressurestat automatically resets itself when the cut-in pressure is reached. The compressor(s) can then restart under Time Guard® control (minimum 8 minutes between starts of each compressor). A 2 1/2-minute bypass of the low-pressure switch is provided by the timer at start-up of the lead compressor in each circuit. Under winterstart conditions, this prevents nuisance trips on the low-pressure switch.

Table 4 — Pressure Switch Factory Settings (psig)

CONTROL	COMPRESSOR	CUTOUT	DIFFERENTIAL
High	1 and 3	400 ± 5	100 ± 15
	2 and 4	375 ± 5	80 ± 10
Low	2 and 4	29 ± 5	15 ± 5

NOTE: No 1 and 3 are lead compressors
No 2 and 4 are lag compressors
The low-pressure switch on each lag compressor is for the circuit

RELIEF DEVICES

Fusible plugs are located in various locations in each circuit to protect against damage from excessive pressures.

High-Side Protection — Device is located between the condenser and the filter-drier and will relieve on temperature rise to 210 F.

Filter-Drier — Device is located on the filter-drier and will relieve on temperature rise to 208 F — 220 F.

Low-Side Protection — Device is located on the suction line, and will relieve on temperature rise to 170 F.

ACCESS FOR SERVICING

The lower screens on the sides and ends of the unit are all removable, and allow easy access to compressors, cooler, piping, fan motors and drives, and refrigerant circuit components. In addition, solid panels at the center of each side are removable for access to condenser headers.

Removal of the 2 solid panels at each end of the unit reveals the electrical boxes for both circuits and the unit control box. This provides access to the circuit breakers, ON-OFF switches, control fuses, temperature controls, lights and convenience outlets without being exposed to current carrying components. To service electrical components, the electrical box covers can be removed. The control panel at the no. 1 circuit end has a hinged cover.

Electrical Boxes — Identical boxes, one at each end of the unit, contain separate sets of electrical components, one set for each circuit. Each box contains the following:

1. Main power terminal block to receive incoming power.
2. Circuit breakers with calibrated magnetic trip for motor overload and locked rotor protection. There is one for each compressor and the fan motor for that circuit.
3. Motor contactors, definite purpose type.
4. High-pressure cutout for each compressor.
5. Low-pressure cutout for that circuit.
6. Convenience outlet, 115 volt (60-Hertz only).
7. Switch to stop the lag compressor in that circuit.
8. Miscellaneous timers and relays

Control Box — A single box for the unit is located to the right of the electrical box at the circuit no. 1 end. This box contains the following (inside):

1. Step controller
2. Control circuit terminal block
3. Auxiliary interlock terminal block
4. Two discharge pressure switches for cycling no. 1 fan.
5. Cooler heater thermostat
6. General control terminal block

Mounted on the outside of the box:

1. Temperature controller
 2. Low Water Temperature Cutout
- The control panel (hinged cover on control box) has mounted on it the following:
1. Unit ON-OFF switch
 2. Control circuit fuse
 3. Compressor run lights
 4. Safety trip lights
 5. Reset buttons

COOLER REMOVAL

From Side of Unit

1. Remove water piping.
2. Disconnect conduits to solenoid valves and cooler heater cables.
3. Remove both liquid lines running from condenser outlet junction to cooler head.
4. Place supports under the two condenser center cross channels, inboard of the cooler.
5. Remove all screws and bolts in the 2 upright supports at the center of the unit on the cooler side. Remove uprights.
6. Unbrazed suction line sections at cooler and remove.
7. Remove temperature controller and low temperature cutout sensor bulbs from wells.
8. Slide cooler out thru side of unit.

→ **From End of Unit** — Follow same procedure as for side removal except do not remove upright support. Remove the diagonal brace at one end of unit and slide cooler out.

CONDENSER COIL REMOVAL

Inboard Coils

1. Remove the electrical box (and control box if removal is from circuit no. 1 end).
2. Remove the "V" baffles between coils.
3. Unbrazed the refrigerant line connections at the header.
4. Remove the 2 screws in the bottom of each tube sheet.
5. Slide coils out the end.

Outboard Coils — Follow same procedure as for inboard coils except the adjacent inboard coil must be removed first in order to miss the corner post when removing the outboard coil.

ALTERNATE METHOD — Remove the fan and fan decks and lift coils out the top without removing the electrical or control boxes.

CONDENSER COIL CLEANING

Clean coils with a vacuum cleaner, fresh water, compressed air or a bristle brush (not wire). Units installed in corrosive environments should have coil

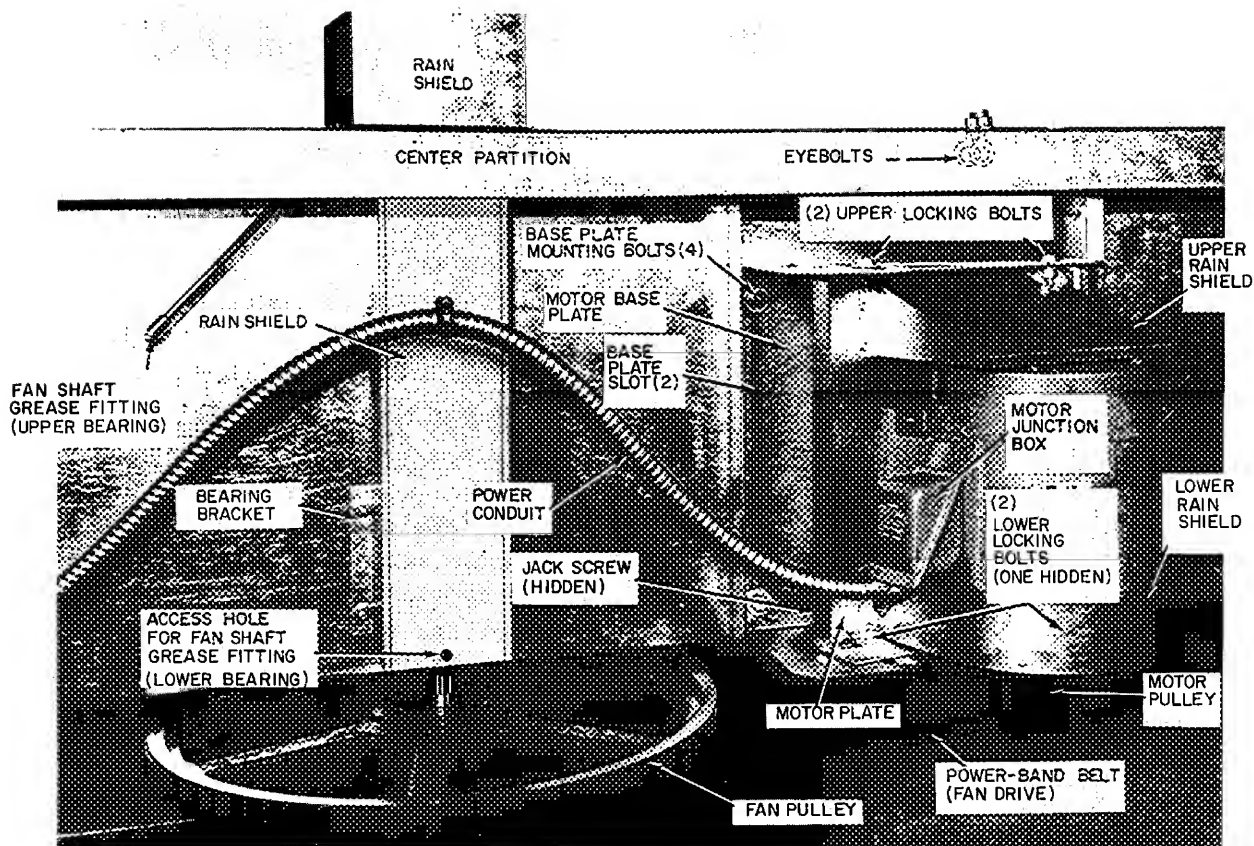


Fig. 5 – Fan Motor and Drive (Fan Motor No. 2 Shown)

cleaning as part of a planned maintenance schedule. In this type of application, all accumulations of dirt should be washed off the coil.

FANS AND FAN MOTORS

IMPORTANT After 100 hours of operation, tighten the fan bolts (from nut side only) Torque as follows. blade bolts – 75 lb-ft, hub rim bolts and bushing screws (3 each) – 30 lb-ft.

Fan Motor Removal (refer to Fig. 5) – Before starting, be sure power to the unit is disconnected. Remove the lower screen panels on the side opposite the cooler. Viewed from this side, fan no. 2 is on the left and fan no. 1 is on the right. Fig. 5 shows motor and drive for fan no. 2.

First remove the upper and lower rain shields and disconnect the power wires at the motor junction box. Directly above each motor, in the top flange of the center partition, are 2 eyebolts. Insert a 1/2-in. bolt, 2 1/2 in. long, thru both eyebolts and secure with a nut. Pass a cable between the eyebolts and over the 1/2-in. bolt and wrap the end securely around the motor. Attach the other end of the cable to a winch or a come-along secured to one of the base cross rails and draw the cable up tightly.

With the motor thus secured, loosen the upper and lower motor-locking bolts and remove the jack screw, which relieves the belt tension; remove the drive belt. Remove the 2 mounting bolts at the top

of the vertical slots in the motor base plate and loosen the 2 corresponding lower bolts. Now lower the motor to the bottom of the vertical slots and remove the 2 loose bolts. Lower the motor and base plate to the roof surface or to the ground. For motor installation, reverse the above procedure. Be sure the motor pulley is aligned with the fan pulley.

Belt Tension Adjustment (Fig. 5 and 6) – Loosen the upper and lower motor-locking bolts. With the jack screw, adjust the belt tension to 11 lb at .406-in. deflection as shown in Fig. 6, using a standard belt-tension gage. Tighten the upper and lower motor-locking bolts.

Fan Motor Lubrication – The fan motors should be greased once a year. Lower the motor as described under Fan Motor Removal. At first lubrication, remove the 2 front plugs, at top and

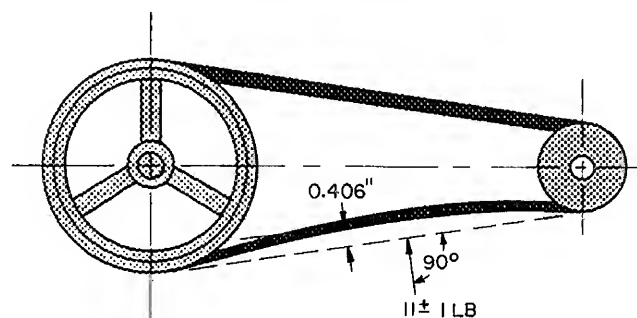


Fig. 6 – Belt Tension

bottom, and install grease fittings. Remove the top and bottom plugs (2) at the back and pump grease slowly into the front fittings until clean grease shows at the back openings. *Before replacing the back plugs*, run the motor for 5 minutes and then replace the plugs. Use Texaco Regal AFB-2 grease or equivalent.

Fan Shaft Bearing Lubrication (see Fig. 5 and 7 for location of grease fittings) — Bearings should be lubricated every 4 months. Use Texaco Regal AFB-2 (Carrier Specification PP80-15). Both the upper and lower bearings can be greased from below. Feed the grease slowly until it starts to come out at the bearing seals.

Fan Removal and Installation — To remove the fan, proceed as follows:

1. Remove the fan guard.
2. Support the fan from above with a sling or by other means.
3. Remove the 3 bolts in the fan bushing.
4. The fan should drop off the bushing. If it does not, loosen bushing with the jack screws (use 2 of removed screws, in threaded holes in bushing).
5. Remove bushing and lift fan off the shaft. Keep the key with the bushing.

When reinstalling the fan, lower the fan over the shaft. (It will rest on top of the rain shield.) Be sure the key is in place, insert the bushing into the fan hub and start the 3 bolts. Be sure the bottom of the bushing is down on the spacer (see Fig. 7) and then tighten the 3 bolts evenly until the bushing is tight on the shaft. As the bushing is drawn tight into the fan hub, the fan will be lifted off the rain shield, leaving the bushing resting on the top of the spacer. This automatically positions the fan at the proper level and no further adjustment is necessary.

Fan Shaft Removal and Installation — To remove the shaft, proceed as follows (refer to Fig. 5 and 7):

1. Remove the fan as described under Fan Removal and slide the spacer off the shaft.
2. Remove the rain shields.
3. Loosen the motor locking bolts and back off the jack screw behind the motor (see Fig. 5) to relieve belt tension. Remove the belt.
4. Support the fan pulley and remove the pulley bushing and key.
5. Lower the pulley off the shaft.
6. The shaft can now be removed from top or bottom by loosening the set screws in the upper and lower bearings.

When replacing the shaft, adjust to the 2 1/4-in. dimension shown in Fig. 7 before tightening the upper and lower set screws. Then reverse the

removal sequence to complete the installation. When replacing the pulley, adjust to the 2-in. dimension shown in Fig. 7.

Fan Shaft Bearing Replacement — Remove fan and shaft as described under Fan Removal and Fan Shaft Removal. Detach bearing(s) by removing the 4 bolts holding each bearing. When replacing the bearing(s) be sure the lubrication points are in the original position (grease fitting in lower bearing must be aligned with access hole in rain shield).

If both bearings are replaced, secure the upper bearing and install the lower one loose. Insert the fan shaft, from top or bottom, adjust to the 2 1/4-in. dimension in Fig. 7 and tighten the set screw in the *upper* bearing. Secure the lower bearing and tighten the set screw, being sure the shaft turns freely.

If only one bearing is replaced, do nothing to the other bearing. Install the new bearing loose. Insert the fan shaft, adjust to the 2 1/4-in. dimension and tighten the set screw in the fixed bearing. Secure the new bearing and tighten the set screw, being sure the shaft turns freely.

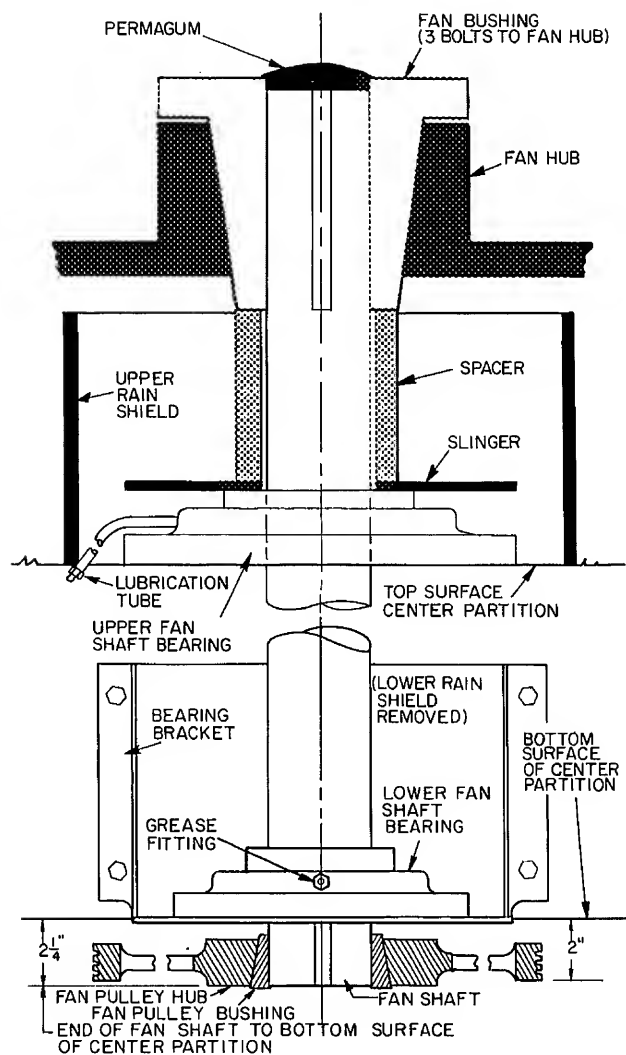


Fig. 7 — Fan, Shaft and Bearings Assembly

HEAD PRESSURE CONTROL

Fan Cycling (Standard Unit) — Fully automatic “intermediate season” air-side head pressure control is accomplished by cycling the no. 1 condenser fan. This is done by means of 2 pressure controllers which respond to variations in discharge pressure of either circuit. Fan no. 1 stops on pressure drop to 160 psig and starts on pressure rise to 260 psig. Both controllers are nonadjustable. Number 2 fan runs whenever cooling is called for.

Factory Installed Option (FIOP) — A 2-speed fan motor replaces the standard no. 2 motor and is controlled by an ambient temperature switch. If the ambient temperature is above 20 F, fan no. 2 will run full speed; if ambient is below 20 F, fan no. 2 will run half speed. Fan no. 1 operates the same as in the standard unit.

CAPACITY CONTROL

Controls cycle compressors and alternately load and unload cylinders to give capacity control steps as shown in Table 5. Controls for each unit include a step controller, a chilled water temperature controller and one solenoid-operated cylinder unloader (on compressor no. 1).

Table 5 — Capacity Control Steps

UNIT 30GA	CONTROL STEPS	% CAP.		OPER CYLINDERS				
		Hertz		Total	Compr No.			
		60	50*		1	2	3	4
085	1	20	16.7	4	4	—	—	—
	2	30	25	6	6	—	—	—
	3	50	41.7	10	4	—	6	—
	4	60	50	12	6	—	6	—
	5	70	66.7	14	4	4	6	—
	6	80	75	16	6	4	6	—
	7	90	91.7	18	4	4	6	4
	8	100	100	20	6	4	6	4
→ 105 and 120	1	16.7		4	4	—	—	—
	2	25		6	6	—	—	—
	3	41.7		10	4	—	6	—
	4	50		12	6	—	6	—
	5	66.7		16	4	6	6	—
	6	75		18	6	6	6	—
	7	91.7		22	4	6	6	6
	8	100		24	6	6	6	6
→ 110	1	14.4		4	4	—	—	—
	2	21.6		6	6	—	—	—
	3	35.9		10	4	—	6	—
	4	43.1		12	6	—	6	—
	5	64.4		16	4	6	6	—
	6	71.6		18	6	6	6	—
	7	92.8		22	4	6	6	6
	8	100.0		24	6	6	6	6

*Data under OPERATING CYLINDERS for 50-Hz 30GA085 same as 105

Step Controller — A 24-volt transformer in the step controller provides power to a low-voltage motor with windings for rotating a camshaft clockwise and counterclockwise. Factory-set cams operate load switches which start or stop compressors and load or unload cylinders. Motor windings of

camshaft drive motor are energized by a balancing relay which contains windings in the temperature bridge circuit between chilled water temperature controller and motor balancing potentiometer located at end of camshaft. When unit is unloading or loading (respectively, counterclockwise or clockwise rotation of the camshaft drive motor), each chilled water temperature corresponds to a position of the camshaft. Camshaft rotation is limited in each direction by limit switches. Direction of rotation is as viewed from the potentiometer end of the controller.

A recycle relay in the step controller ensures that the camshaft will rotate counterclockwise (in the unload direction) to the correct position to begin the compressor starting sequence at initial start-up or after a power interruption. After completion of the reset cycle, the camshaft rotation changes to clockwise and the compressor starting sequence begins.

Compressors start one at a time at brief intervals until the load demand is satisfied. After completing the starting sequence, the controller unloads and loads compressor no. 1 and stops and starts all the compressors to maintain unit cooling capacity to satisfy load requirements.

Chilled Water Temperature Controller (Fig. 9) — A sensing bulb is factory inserted in the return water nozzle of the chilled water system to relay water temperature to potentiometer which actuates step controller. *Cams in step controller are factory-set to control from return water temperature.* If unit is to be applied with control bulb in leaving chilled water line, cams must be reset in field. If this is required, contact local Carrier representative.

Adjust set point (main scale) and throttling range (modulating) of chilled water temperature controller before initial start-up.

Set point = design leaving chilled water temperature (LCWT) minus “X” value. “X” values, established by test, are such that the compressor is prevented from cycling more than once in a 5-minute period. See Table 6.

Throttling Range = Design Rise + “X” value. Enter graph, Fig. 9, at set point and move across to intersection of throttling range. Read setting from top scale (min to F).

Example: 4-compressor unit, 10 F Design Rise and 45 F LCWT

$$\text{Set} = 45 - 1 = 44 \text{ F}$$

$$\text{Throttling Range} = 10 + 1 = 11 \text{ F}$$

Table 6 — “X” Values

NO. OF COMPRESSORS	DESIGN RISE		
	8 F	10 F	12 F
4	0.75	1.0	1.25

SEQUENCE OF OPERATION

Before initial start-up, or after a prolonged shutdown, the crankcase heaters should be on for 24 hours before starting the unit.

At initial start-up, assume all safety devices are satisfied and the water temperature controller is calling for full cooling capacity.

Place the control circuit switch (SW1) at ON position. This is Time Zero in the sequence of actuating the step controller switches 1-8 shown in Table 7. The times from Time Zero listed in the first column are approximate. *These times and the sequence data are based on the temperature controller calling for full cooling capacity when SW1 is turned on.* Under this condition, the step controller motor will rotate the load-switch cam shaft counterclockwise (viewed from potentiometer end) to the *fully unloaded* position before switching over and rotating clockwise to actuate the load switches 1-8 in sequence. Thus, on initial start-up, the switches will be actuated strictly on a time basis because the temperature rise to full capacity demand is already complete. Each compressor will be started under the control of its timer, which delays starting for 12 seconds after the applicable step controller switch is made. Under these conditions, initial start-up may take up to 17 minutes to complete the sequence because of random timer positions (see Timer Functions).

Under normal operation, the combined action of the temperature controller and the step controller will start and stop compressors and load and unload cylinders to maintain capacity control as shown in Table 5.

TIMER FUNCTIONS (Fig. 8)

1. Contacts D-D1, in load timer of each circuit, provide 2-1/2 minute bypass of the low-pressure switch on start-up of lead compressor, for winter start control. If the low-pressure switch for either circuit does not close within 2-1/2 minutes, that circuit only will shut off and remain off until the low-pressure switch contacts close.
2. Contacts B-B1, B-B2 provide one-second time delay for part-winding start.
3. Contacts A-A1, A-A2 run the timer motor. After a compressor shuts off, there is a minimum 5-1/2 minute time delay before it can restart. These contacts also provide for a minimum time of 8 minutes between starts of each compressor.

CONTROL CIRCUIT

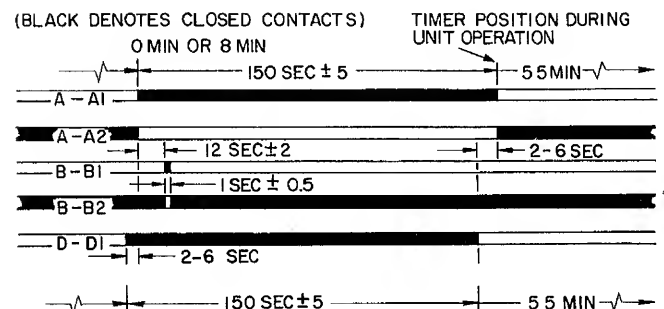
General

1. Condenser fan no. 2 will run anytime there is a demand for cooling, even though circuit no. 1 is out on a safety device.

2. In each circuit, the lag compressor cannot start until 12 seconds after the lead compressor starts. If the lead compressor is off on high-pressure, low-pressure or overtemperature protection, the lag compressor cannot start.
3. In each circuit, the lag compressor cannot run unless the lead compressor control circuit is energized. When the lag compressor is stopped by the low-pressure cutout, the lead compressor also stops. No other safety device stopping the lag compressor will affect the lead compressor.
4. Each compressor crankcase heater is energized continuously to prevent refrigerant condensation in the crankcase.
5. The liquid line solenoid valve in each circuit is de-energized at the same time the lead compressor is cycled off.
6. A manual switch is provided to each lead compressor control circuit to electrically isolate the lag compressors individually for service work, or for partial load operation during intermediate seasons when all compressors are not required.
7. Each compressor can cycle on high pressure. However, this cycling should not be allowed to continue, and the cause should be determined and corrected before the unit is allowed to resume operation.
8. In each circuit, if the LOW-PRESSURE switch (LPS) is not closed within 2-1/2 minutes after start-up, the compressor(s) will stop.

In each circuit, if LPS opens during normal compressor operation (after 2-1/2 minutes from starting), compressor(s) will stop and will restart automatically after approximately 5-1/2 minutes. Operation will continue for 2-1/2 minutes thru timer contacts D-D1, bypassing LPS. If LPS is not closed by this time, the compressor(s) will stop and the circuit will be de-energized.

In both of the above cases, LPS must be closed before the timer can recycle to restart the compressor(s).



NOTE: Timers for lag compressors do not use switch D

Fig. 8 — Timer Cycle

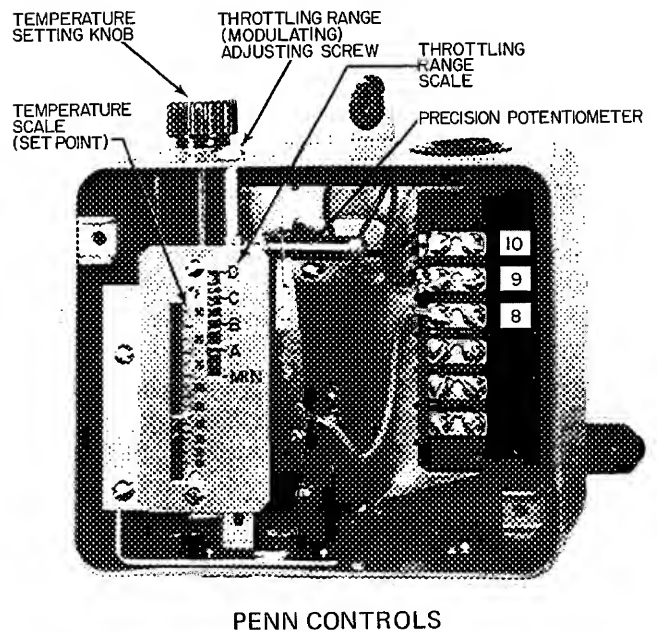
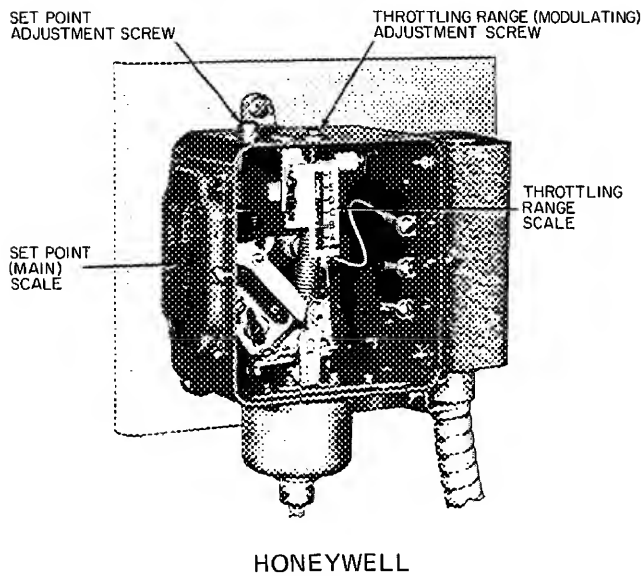
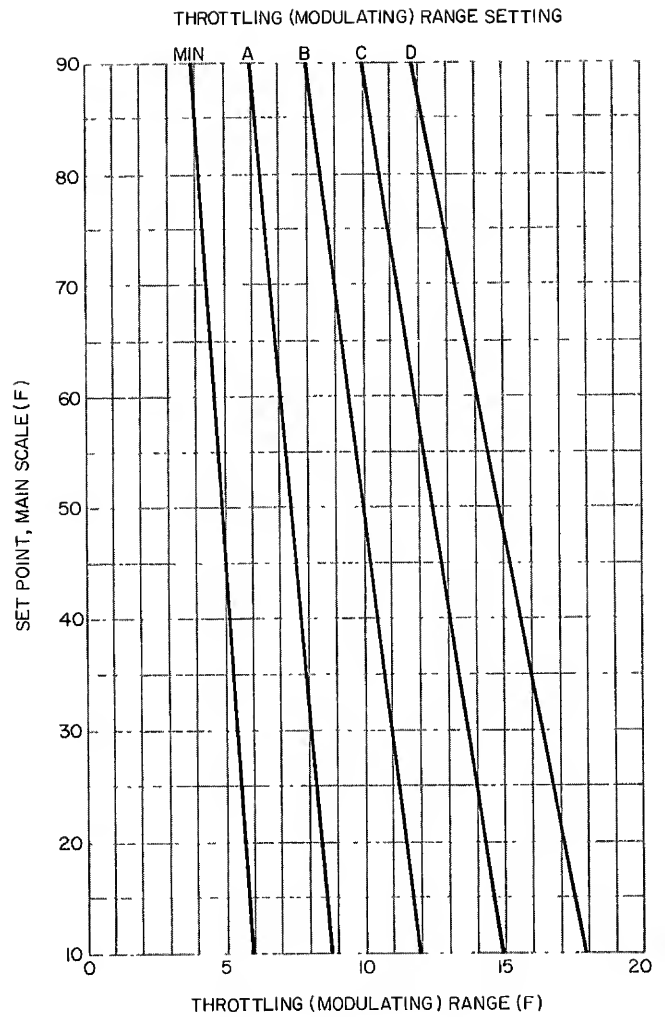
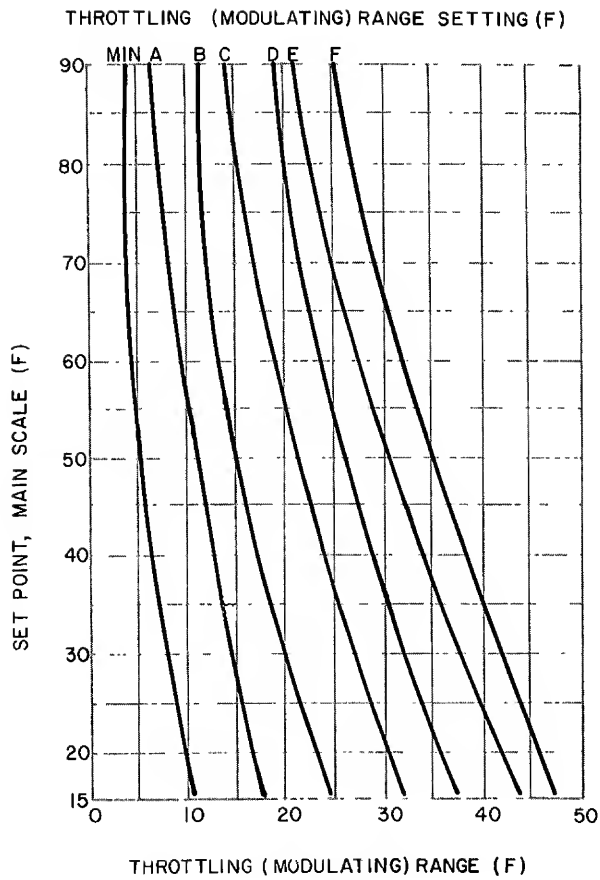


Fig. 9 – Chilled Water Temperature Controller

→ **Complete Unit Stoppage** can be caused by:

1. General power failure.
2. Open control circuit ON-OFF switch (SW1).
3. Open contacts of any auxiliary interlock.
4. Chilled water flow switch open.
5. Chilled water temperature drops below set point of low water temperature cutout, or below set point of temperature controller.
6. Blown control circuit fuse.

Individual Circuit Stoppage can be caused by:

1. Open LOW-PRESSURE switch.
2. Open HIGH-PRESSURE switch for lead compressor.
3. Open OVERTEMPERATURE switch for lead compressor.
4. Depressing the reset button for that circuit.

Individual Compressor Stoppage can be caused by:

1. Any compressor – open circuit breaker.
2. Either lag compressor – open HIGH-PRESSURE switch.
3. Either lag compressor – Open ON-OFF switch (SW2 or SW3).

4. Either lag compressor – open OVER-TEMPERATURE switch.

If the unit, or single circuit or single compressor stops more than once as a result of a safety device, do not attempt to start again until the cause for stoppage is determined and corrected.

Restart After Abnormal Stoppage

GENERAL POWER FAILURE – Step controller will recycle when power is restored and safety devices will be automatically reset. Restart controlled thru timer.

HIGH-PRESSURE SWITCH – When switch contacts close, restart is automatic, thru the timer.

LOW-PRESSURE SWITCH – Same as HIGH-PRESSURE switch.

LOW WATER TEMPERATURE CUTOUT – Press reset button on the control. Restart will be thru the step controller and timer.

COMPRESSOR OVERTEMPERATURE PROTECTION – Press the circuit reset button. Allow time for compressor to cool enough for the thermal contacts to reset. Restart controlled thru timer.

Table 7 – Step Controller Sequence

FROM TIME ZERO (SEC.)	STEP CONTROLLER SWITCH (MAKES)	ACTION CALLED FOR BY STEP CONTROLLER	ACTUAL ACTION	COMMENTS
4	1	Start compr no. 1 unloaded Start fan no. 1 Start fan no. 2	None None Fan no. 2 starts	Awaiting action of timer no. 1 Awaiting disch press rise (compr no. 1) —
16	2	— Load compr no. 1	Compr no. 1 starts unl. Load compr no. 1	On action of timer no. 1 —
23	3	Start compr no. 3 loaded Unload compr no. 1	None Compr no. 1 unloads	Awaiting action of timer no. 3 —
35	—	—	Compr no. 3 starts loaded	On action of timer no. 3
36	4	Load compr no. 1	Load compr no. 1	—
48	5	Start compr no. 2 loaded Unload compr no. 1	None Compr no. 1 unloads	Awaiting action of timer no. 2 —
60	—	—	Compr no. 2 starts loaded	On action of timer no. 2
65	6	Load compr no. 1	Load compr no. 1	—
76	7	Start compr no. 4 loaded Unload compr no. 1	None Compr no. 1 unloads	Awaiting action of timer no. 4 —
88	—	—	Compr no. 4 starts loaded	On action of timer no. 4
89	8	Load compr no. 1	Load compr no. 1	—
Depends on Outdoor Ambient Temp	—	—	Fan no. 1 starts	Assume discharge pressure of either circuit rises to 260 psig

TROUBLESHOOTING

SYMPTOMS	CAUSE	REMEDY	SYMPTOMS	CAUSE	REMEDY
Compressor does not run	Power line open	Reset circuit breaker	System Noises	Piping Vibration	Support piping as required
	Safety thermostat tripped	Reset thermostat		Expansion valve hissing	Check for loose pipe connectors
	Tripped circuit breaker	Check the controls Find cause of trip and reset breaker		Compressor noisy	Add refrigerant
	Contactor stuck open	Replace contactor	Compressor loses oil	Check for plugged liquid line strainer	Check valve plates for valve noise
	Loose terminal connection	Check connections		Replace compressor (worn bearings)	Check for loose compressor hold-down bolts
	Improperly wired controls	Check wiring and rewire		Leak in system	Repair leak
	Low line voltage	Check line voltage — determine location of voltage drop and remedy deficiency		Plugged or stuck compressor snifter valve	Repair or replace
	Compressor motor defective	Check motor winding for open or short Replace compressor, if necessary	Frosted or sweating suction line	Crankcase heaters not energized during shutdown	Replace heaters, check wiring
Compressor stops on low-pressure control	Seized compressor	Replace compressor		Expansion valve admitting excess refrigerant	Adjust expansion valve
	Chilled water flow switch open	Check chilled water pump Check switch	Hot liquid line	Shortage of refrigerant due to leak	Repair leak and recharge
	Low-pressure control erratic in action	Raise differential setting Check capillary for pinches Replace control		Expansion valve opens too wide	Adjust expansion valve
	Compressor suction valve leaking	Replace valve plate	Frosted liquid line	Restricted filter-drier	Remove restriction or replace filter-drier
Compressor cycles on high-pressure control	Compressor suction shutoff valve partially closed	Open valve		Burned out coil	Replace coil
	Low refrigerant charge	Add refrigerant	Compressor will not unload	Leaky bypass piston	Clean or replace
	Plugged compressor suction strainer	Clean strainer		Stuck needle valve	Clean
	High-pressure control erratic in action	Check capillary tube for pinches Set control as required		Miswired solenoid	Wire correctly
Unit operates long or continuously	Compressor discharge valve partially closed	Open valve, or replace if defective		Plugged bypass port (low side)	Clean
	Air in system	Purge	Compressor will not load	Weak bypass piston spring	Replace
	Condenser fan(s) not operating	Check motor and wiring Repair or replace if defective		Damaged bypass piston	Replace
	Low refrigerant charge	Add refrigerant		Stuck needle valve	Clean
Unit operates long or continuously	Control contacts fused	Replace control	High Suction	Miswired solenoid	Wire correctly
	Air in system	Purge		Plugged bypass port strainer (high side)	Clean
	Partially plugged or plugged expansion valve or strainer	Clean or replace		Stuck check valve in valve plate	Examine check valve components, clean or replace as necessary
	Defective insulation	Replace or repair		Stuck check valve in valve plate	Examine check valve components Clean or replace as necessary
Unit operates long or continuously	Service load	Keep doors and windows closed	Chattering unloader		
	Inefficient compressor	Check valves, replace if necessary			

For replacement items use Carrier Specified Parts.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.